

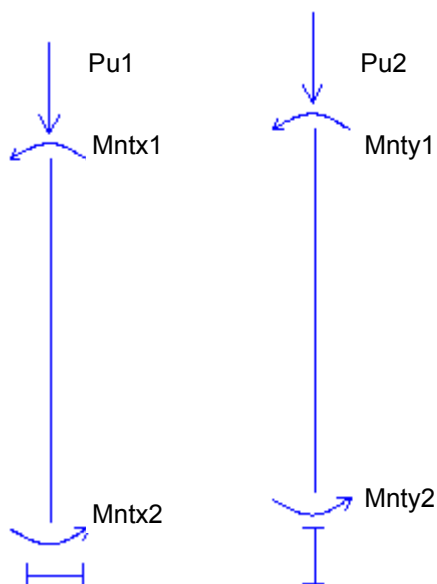
## BAB VI

### PERENCANAAN KOLOM K3

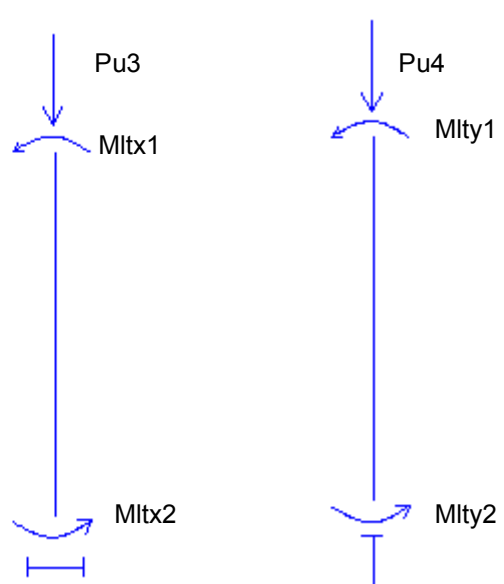
#### 6.1 Kolom dipakai profil H 200 x 200 x 8 x 12

$W := 49.9$	kg/m'	$I_x := 4720$	cm <sup>4</sup>
$A_g := 63.53$	cm <sup>2</sup>	$I_y := 1600$	cm <sup>4</sup>
$d := 200$	mm	$i_x := 8.62$	cm
$b_f := 200$	mm	$i_y := 5.02$	cm
$t_w := 10$	mm	$S_x := 472$	cm <sup>3</sup>
$t_f := 12$	mm	$S_y := 160$	cm <sup>3</sup>
$r := 13$	mm	$Z_x := 472$	cm <sup>3</sup>
$h := d - 2 \cdot (t_f + r) = 150$	mm	$Z_y := 160$	cm <sup>3</sup>
BJ 37 : $f_y := 240$ Mpa		$E := 2 \cdot 10^5$ Mpa	
$f_u := 370$ Mpa			

#### KOLOM TAK BERGOYANG ( D + L )



#### KOLOM BERGOYANG ( GEMPA )



#### DARI HASIL ANALISA SAP 2000 DIDAPAT :

$Pu1 := 26454.37$  kg       $Pu3 := 26454.37$  kg

$Pu2 := 2936.92$  kg       $Pu4 := 2936.92$  kg

Tanpa goyangan :     $Mntx1 := 9402.48$  kgm  
                               $Mntx2 := 8987.18$  kgm

Dengan goyangan :    $Mltx1 := 9402.48$  kgm  
                               $Mltx2 := 8987.18$  kgm

$$\Sigma Nu := (14 \cdot Pu1) = 370361.18 \quad \text{kg}$$

- Untuk arah X

$$I_{xc} := I_x = 4720 \quad \text{cm}^4 \quad (\text{kolom})$$

$$I_{xb} := 4050 \quad \text{cm}^4 \quad (\text{balok})$$

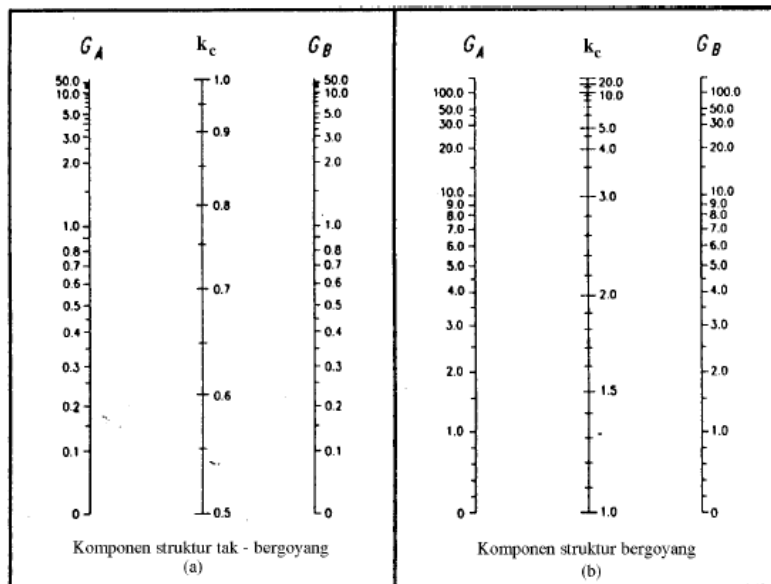
$$G_A := \frac{\left( \frac{I_{xc}}{250} \right)}{\left( \frac{I_{xb}}{250} \right)} = 1.165$$

$$G_B := 1$$

dari nomogram peraturan LRFD ( SNI 03-1729-2002 ) didapatkan :

$$K_{cx1} := 0.78 \quad \text{tak bergoyang}$$

$$K_{cx2} := 1.38 \quad \text{bergoyang}$$



- Untuk arah Y

$$I_{yc} := I_y = 1600 \quad \text{cm}^4 \quad (\text{kolom})$$

$$I_{yb} := 294 \quad \text{cm}^4 \quad (\text{balok})$$

$$G_A := \frac{\left( \frac{I_{yc}}{250} \right)}{\left( \frac{I_{yb}}{250} \right)} = 5.442$$

$$G_B := 1$$

dari nomogram peraturan LRFD didapatkan :

$$K_{cy1} := 0.86 \quad \text{tak bergoyang}$$

$$K_{cy2} := 1.76 \quad \text{bergoyang}$$

- Kontrol Penampang

$$\text{Badan} \quad \frac{h}{t_w} = 15 \quad \blacksquare \leq \blacksquare \quad \frac{1680}{\sqrt{f_y}} = 108.444$$

$$\text{Sayap} \quad \frac{b_f}{2 \cdot t_f} = 8.333 \quad \blacksquare \leq \blacksquare \quad \frac{170}{\sqrt{f_y}} = 10.973$$

Penampang kompak  $M_{nx} = M_{px}$

- Kontrol Kelangsingan Kolom

A. Kolom bergoyang

$$\lambda_x := \frac{250 \cdot K_{cx2}}{i_x} = 40.023$$

$$\lambda_y := \frac{250 \cdot K_{cy2}}{i_y} = 87.649 \quad \text{Menentukan !!}$$

Tekuk kritis arah y :  $\lambda_y > \lambda_x$

$$\lambda_c := \left( \frac{\lambda_y}{\pi} \right) \cdot \sqrt{\frac{f_y}{E}} = 0.966 \quad \dots\dots\dots \lambda_c > 1.2$$

$$\omega := 0.25 \cdot \lambda_c^2 = 0.234$$

$$\Phi P_n := \frac{0.85 A_g \cdot f_y \cdot 10}{\omega} = 554995.67 \quad \text{kg}$$

$$P_u := P_{u1} = 26454.37 \quad \text{kg}$$

$$\frac{P_u}{\Phi P_n} = 0.048 \quad \blacksquare < \blacksquare \quad 0.2 \quad \text{Rumus interaksi 2}$$

$$N_{crx} := \frac{A_g \cdot E \cdot 10 \cdot \pi^2}{\lambda_c^2} = 1342546006.416 \quad \text{kg}$$

$$N_{cry} := \frac{A_g \cdot E \cdot 10 \cdot \pi^2}{\lambda_c^2} = 1342546006.416 \quad \text{kg}$$

$$\Sigma N_{crsx} := 2 \cdot N_{crx} = 2685092012.832 \quad \text{kg}$$

$$\Sigma N_{crsy} := 7 \cdot N_{cry} = 9397822044.91 \quad \text{kg}$$

B. Kolom tak bergoyang

$$\lambda_{x1} := \frac{250 \cdot K_{cx1}}{i_x} = 22.622$$

$$\lambda_{y1} := \frac{250 \cdot K_{cy1}}{i_y} = 42.829$$

$$N_{crbx} := \frac{\pi^2 \cdot A_g \cdot E \cdot 10}{\lambda_{x1}^2} = 55434642.469 \quad \text{kg}$$

$$N_{crby} := \frac{\pi^2 \cdot A_g \cdot E \cdot 10}{\lambda_{y1}} = 29280187.51 \quad \text{kg}$$

- Momen Ultimate

- Terhadap sumbu X

$$C_{m1} := 0.6 - 0.4 \cdot \left( \frac{M_{ntx2}}{M_{ntx1}} \right) = 0.218$$

$$\delta_{bx} := \frac{C_{m1}}{1 - \left( \frac{P_{u1}}{N_{crbx}} \right)} = 0.218 \quad \blacksquare < \blacksquare 1$$

$$\delta_{bx} := 0.231$$

$$\delta_{sx} := \frac{1}{1 - \left( \frac{6 \cdot P_{u1}}{\sum N_{crsx}} \right)} = 1$$

$$M_{ux} := \delta_{bx} \cdot M_{ntx1} + \delta_{sx} \cdot M_{ltx1} = 11575.009 \quad \text{kgm}$$

- Kontrol Momen Nominal

#### **Kontrol local buckling**

$$\text{Badan} \quad \frac{h}{t_w} = 15 \quad \blacksquare \leq \blacksquare \quad \frac{1680}{\sqrt{f_y}} = 108.444$$

$$\text{Sayap} \quad \frac{b_f}{2 \cdot t_f} = 8.333 \quad \blacksquare \leq \blacksquare \quad \frac{170}{\sqrt{f_y}} = 10.973$$

$$\lambda_r := \frac{370}{\sqrt{240 - 70}} = 28.378 > \lambda = 9.375 \quad \text{Penampang kompak!!}$$

#### **Terhadap sumbu x**

$$M_{nx} := Z_x \cdot f_y \cdot 10 = 1132800 \quad \text{kgcm}$$

$$M_y := S_x \cdot f_y \cdot 10 = 1132800 \quad \text{kgcm}$$

$$M_{nx} = 1132800 \quad \text{kgcm} \quad \blacksquare \leq \blacksquare \quad 1.5 \cdot M_y = 1699200 \quad \text{kgcm}$$

#### **Terhadap sumbu y**

$$M_{ny} := Z_y \cdot f_y \cdot 10 = 384000 \quad \text{kgcm}$$

- Kontrol lateral buckling

$$L_b := 100 \quad \text{cm}$$

$$L_p := 1.76 \cdot i_y \cdot \sqrt{\frac{2 \cdot 10^5}{f_y}} = 255.05 \quad \text{cm}$$

$$h_w := h - 2 \cdot (r + t_f) = 100 \quad \text{mm}$$

$$J := \frac{(h_w - 2 \cdot t_f)}{3 \cdot 10^4} \cdot t_f^3 + \frac{2}{3 \cdot 10^4} \cdot b_f \cdot t_f^3 = 27.418 \quad \text{cm}^4$$

$$I_w := \frac{I_y \cdot (h - t_f)^2}{4 \cdot 100} = 76176 \text{ cm}^6$$

$$x_1 := \frac{\pi \cdot \sqrt{\frac{(2 \cdot 10^6 \cdot 0.8 \cdot 10^6 \cdot J \cdot A_g)}{2}}}{Z_x} = 248460.305 \text{ kg/cm}^2$$

$$x_2 := 4 \cdot \left( \frac{Z_x}{0.8 \cdot 10^6} \right)^2 \cdot \frac{I_w}{I_y} = 0.000066 \left( \frac{\text{cm}^2}{\text{kg}} \right)^2$$

$$L_R := i_y \cdot \left( \frac{x_1}{2400 - 700} \right) \cdot \sqrt{1 + \sqrt{1 + x_2 \cdot (2400 - 700)^2}} = 2829.935 \text{ cm}$$

$L_p < L_b < L_r$  bentang menengah

- Kontrol Interaksi beam column

$$\left( \frac{P_u}{\Phi P_n} \right) + \left[ \left( \left( \frac{M_{ux} \cdot 100}{0.9 \cdot M_{nx}} \right) \right) \right] = 0.835 \leq 1$$

**Jadi H 200 x 200 x 8 x 12 dapat digunakan sebagai profil kolom**